

Development and Implementation of a “Counter-Top” Training Program to Increase Retention of Food Safety Knowledge, Alter Behavior, Improve Attitude and Increase Skills of Spanish-speaking Retail Employees



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SUMMARY

Foodborne illness is a concern that is compounded by lack of food safety training, cultural differences, and language barriers in foodservice industries. Needs assessments of Spanish-speaking food handlers from Reading, PA, were conducted by concealed-direct observations, collection of demographic data (gender, country of origin, years of school completed, age in years, years worked in a retail setting, years owning a store, number of employees at this store; part-time or full-time, and number of different customers per week) and manager preference of training surveys. The results assisted in the development of a customized “counter-top” food safety training program that addressed common food safety issues occurring in small meat shops, known as *carnicerías*. Training was designed to increase retention of food safety knowledge, improve attitude, alter behavior, and increase skills of Spanish-speaking employees. The inclusion criteria required establishments have a meat display case, a meat slicer, employees >18 years of age, and employees whose first language was Spanish. Twenty *carnicerías* were assigned to two treatments groups: control (no training) or face-to-face (FTF) training. The FTF training included four food safety assessments: knowledge, attitude, behavior, and a skill performance. Assessments were given pre-training, post-training, and delayed-post training. ANCOVA for knowledge and skill results demonstrated a significant difference in post-test and delayed post-test scores when controlling for the pre-test scores of the FTF-trained group. Findings demonstrated that while food safety attitude and behavior changes were not changed significantly, improvements were observed in food safety knowledge and skill. This type of training program could impact establishments positively to improve food safety practices of Spanish-speaking employees.

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INTRODUCTION

According to the Centers for Disease Control and Prevention (CDC), an estimated 48 million cases of foodborne disease occur each year in the United States, affecting approximately 1 in 6 people. The CDC also estimates that 128,000 hospitalizations and 3,000 deaths are related to foodborne diseases annually (3). Compounding these problems with foodborne outbreaks is that many consumers demand foods that are ready to eat (RTE), such as delicatessen products, or minimally processed, such as fruits and vegetables. However, these types of foods often require additional handling, thereby making them more susceptible to contamination (24).

The literature has demonstrated that mishandling food can play a significant role in the occurrence of foodborne illness (5) and certain critical behaviors, such as lack of proper personal hygiene, cross-contamination issues, and improper temperature holding of foods (11), can lead to outbreaks. Of these behaviors, the single most critical factor in the spread of foodborne illness is thought to be worker hand contact with pathogens from their gastrointestinal tracts or environmental surfaces. This factor makes handwashing extremely important in the prevention of communicable diseases (5).

Lubran et al. (10) observed food handlers in retail delicatessens from chain and independently-owned stores and found that proper handwashing occurred approximately 11% of the time. In addition to handwashing, barriers such as disposable gloves or utensils should be used when working with RTE foods (5).

For food safety practices to be effective in reducing the risk of transmission of foodborne pathogens, food handlers need resources to be educated properly and trained to improve food safety behaviors (24). One study found that employees trained in proper food hygiene techniques were more likely to handle food hygienically than those who did not receive any training (8). In fact, the World Health Organization (27) suggests that the food safety education and training of food handlers (including consumers) is important in preventing foodborne illness.

Food safety education can be defined as the delivery of facts and skills to any person who handles food at any step in the food system (7), requiring sufficient resources, appropriate facilities, relevant training, and good communication channels, as well as motivated workers and management (13). Current food safety training materials for food handlers may include, but are not limited to, training videos, posters, PowerPoint™ presentations, booklets, and discussion techniques (including problem solving and role-playing), as well as other skill sets, practice scenarios or other food safety-related exercises (14).

Mystery shopping or concealed-direct observation is a form of observation in which researchers deceive customer service personnel into believing they are servicing real or potential customers. The goal of concealed-direct observations is to monitor the consistency used in the delivery of a process (26). Researchers are concealed so they can properly observe food handlers without causing any changes in their normal behavior, which may happen when individuals know they are being watched (26). Gupta (6) noted that people change their behavior if they know they are being observed. Mystery shoppers can be trained to be systematic observers and be attentive to the aspects of the service experience, such that regular customers may not notice (16). Concealed-direct observations are often performed in public settings,

so an individual's actions can be observed by the general public. This approach is considered an ethical practice to gather the true behavior of that individual (26). To properly measure the quality of services provided, an adequate sample has to be taken, using a realm of possibilities and including both male and female "shoppers" at different times of the week or day (16). This method allows for the establishment to be observed in order to help the workers in their greatest areas of need.

To date, relatively few studies have used concealed-direct observation for food safety research. One study conducted by Rheinlander et al. (20), used general observations to ascertain street vendor food safety in Ghana. Worsfold and Griffith (28) used direct observation in a consumer study measuring standards of food safety behavior, and found that most participants engaged in risky behaviors for a variety of cooking activities. However, Godwin and Chambers (4) suggested that direct observations are an underused method for collecting data during a needs assessment.

The Transtheoretical Model (TM) (9, 18, 23) is intended to explain or predict a person's success or failure in achieving a proposed behavior change (22). TM can help determine an individual's felt and unfelt needs regarding a behavior that needs to be changed; this approach can be inferred as an individual's willingness to change. TM was originally developed for smoking cessation; however, it has the potential to be adapted to address food safety practices. Unlike most theory-based models, TM is circular, not linear: a person does not graduate from one stage to the next, leaving one process for another. Instead, the change process could begin at any stage, with opportunities for regression, suggesting that the entire process could take a very long time (22).

Only a few research programs have addressed food safety training programs for Spanish-speaking food handlers (15). An example of a popular Hispanic-owned business in Reading, PA, is the "carnicería" or "bodega," which is Spanish for "butcher shop" or "meat shop." Establishments that lack regular food inspection, such as *carnicerías*, tend to employ low-income, low-educated individuals. Given the growing number of native Spanish-speaking food handlers, the small number of food safety training programs for this audience, and the risk of foodborne illness, a need exists for a food safety educational program targeted specifically to Hispanics working in *carnicerías*.

Because of the food safety risks involved with uneducated workers and the implications for public health, an intervention program using table-top/counter-top training modules for Hispanic workers at *carnicerías* was developed, disseminated, and evaluated.

The objectives of the research were as follows:

1. To determine the food safety training needs of Spanish-speaking employees of *carnicerías*, using mystery shopping;
2. To develop, pilot, and test food safety training modules directed to Spanish-speaking food handlers of *carnicerías*;
3. To demonstrate retention of food safety knowledge, improved attitude, and altered behavior of Spanish-speaking employees of *carnicerías* who undergo food safety training from pre-test to post-test and following delayed post-test; and
4. To demonstrate a change in a food safety skill of Spanish-speaking employees of *carnicerías* from pre-test to post-test as well as a delayed post-test following participation in the training modules.

MATERIALS AND METHODS

Reading, Pennsylvania was identified as a city of interest because it has a high percentage of Hispanic population, the lack of high school and college education among this audience (Hispanic population), and the fact that it had the second highest percentage of Hispanic-owned businesses in the state (25). A list of inclusion criteria was developed for food handlers and *carnicerías*: employees had to be over the age of 18, be Spanish-speaking, have a working meat slicer, and have a refrigerated meat display case.

To determine whether *carnicerías* fell into either the inclusion group or the exclusion group, the researchers visited each establishment for approximately fifteen minutes at the start of the project. During this time, researchers did not buy anything, but determined if the establishments had a working meat slicer, listened to employees to determine language, and assessed approximate age of the employees. This information was used to ascertain if the store met the basic inclusion criteria.

Rather than using a paper-based survey, a needs assessment was accomplished using “mystery shopping” or “concealed-direct observations” in which observations were conducted in ten random *carnicerías* using a criterion-based sample (17). For this needs assessment, *carnicerías* were observed by researchers three times each, in the morning, afternoon and evening, for a total of thirty visits. At each visit, the researchers purchased ready-to-eat (RTE) ham to observe how employees used the meat slicer. An evaluation sheet developed for each observation targeted common food safety practices such as proper handwashing, the use of gloves, wearing proper attire, not chewing gum, not eating, not drinking or not smoking in the service area, and finally, correct storage of food products. Two observers participated in each visit and both individuals filled out the evaluation sheet together, immediately following the visit. The responses would be agreed upon before continuing to the next observation. This information was used to develop objectives and training lessons.

Prior to writing the text for the lessons of the food safety training program, learning objectives were developed so that the employees would be able to accomplish the following tasks by the end of the training lesson:

Lesson 1

1. State and understand the importance of the steps involved in cleaning and sanitizing food contact surfaces;
2. Describe four elements required to effectively clean and sanitize food contact surfaces;
3. Understand safety precautions for chemicals used during the cleaning and sanitizing of food contact surfaces;
4. Understand basic food safety terminology associated with their employment; and
5. Identify surfaces that need to be cleaned and sanitized and the frequency of this process.

Lesson 2

1. State how poor personal hygiene directly affects the safety of food;
2. Demonstrate correct use of gloves and attire for working in a retail deli;
3. State the importance of handwashing and the use of gloves to avoid cross-contamination;
4. Identify situations when handwashing is required; and
5. Demonstrate appropriate hand-washing technique.

The existing ServSafe® Essentials 5th Edition and a sanitation manual (Ecolab; St. Paul, MN) were used as background materials to develop the text for the customized lessons. Food safety training material encompassed those behaviors that were deemed unacceptable and/or that showed a lack of skill during the concealed-direct observations.

The written text is an important part of developing any training program. However, many participants told the researchers that they were unable to read. Given the low literacy levels of the target audience, content was supplemented with photographs and the training program delivered verbally. All photographs used in the training materials were taken on campus at the Pennsylvania State Meats Laboratory (University Park, PA) with Hispanic graduate students as models. This approach ensured that none of the facilities were involved in the development of the food safety training program and ensured that employees or businesses could not be harmed if a negative connotation was associated with the behaviors displayed in the food safety training program. Photographs were staged in order to show proper examples of correct and incorrect behaviors, as well as proper cleaning and sanitation procedures.

The table-top/counter-top training program relied on illustrations and visual aids containing simple messages in two separate lessons. The lessons were designed to be set on a table top/counter top, allowing an instructor to flip through the pages. Each page contained an illustration that corresponded to the text on the following page. This written content was presented as a script so the instructor could read it to participants. During the training session, the instructor flipped through the pages and proceeded through the lesson. It was not necessary for the instructor to memorize all of the text. However, to maintain the integrity of the training (so as to present the information the same way each time the training is given), it is advisable for the instructor to become familiar with it and thoroughly understand it. In this study, the instructor was trained in the delivery of the educational materials and use of the evaluation tools and protocols to ensure consistency in the delivery. The participants were compensated with a gift card with a marginal worth.

A pilot test of the counter-top training program and an evaluation instrument (post-test) were performed to determine reliability. In addition, all materials were reviewed by a bilingual expert (who had no involvement with the program) to ensure content consistency in Spanish and English. All training materials were reviewed by the Pennsylvania State University Institutional Review Board (PSU-IRB),

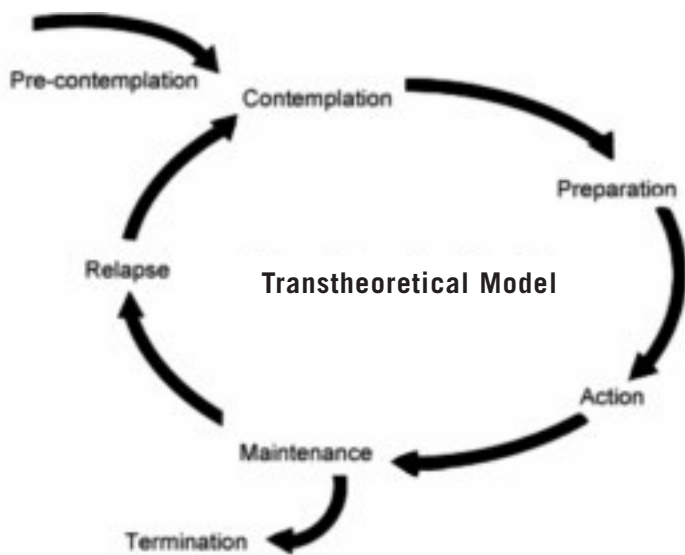
in order to protect the rights of all the subjects involved. These approaches increased the reliability, validity, and ethical quality of the training.

The TM was used to guide the proposed study and increase retention by using only participants who were in the “contemplation stage” (see Fig. 1). During initial screening, all participants were assumed to be in the “pre-contemplation stage.” Those individuals who expressed an “unfelt need” (not willing to answer any surveys or partake in any training) were eliminated from the study.

The findings of initial concealed-direct observations were shared with the participants during the debriefing step, shared with the other *carnicerías*, and used to bring about food safety awareness to the employees working at these stores. Afterwards, researchers returned to the stores to ask the managers to complete an oral survey (measuring the stage of contemplation). At this point in the project, all managers who expressed a “felt need” for food safety training were considered to be in the contemplation stage and were used to complete a mini pilot. The other stores were used for the table-top/counter-top training intervention. It is important to note that none of the stores where the concealed-direct observations took place were used in the intervention.

For the “preparation stage” of the project and to align with the TM, an instructor conducted food safety training lessons based on the needs assessment. The goal of the intervention/training was for the participants to use their own will power to practice the skills learned in the training. A post-test and a delayed post-test were then administered orally to measure the “maintenance” stage or short-term retention of knowledge, change in attitudes, alterations of behavior or increased skill (Fig. 1).

FIGURE 1. Food safety training, adapted from Transtheoretical Model (TM;18)



The pilot test training was conducted at three *carnicerías* that sold RTE meat products. The pilot test also established content validity, since the participants were asked to evaluate the information provided in each module as well as the visual aids, instructor presentation, and Spanish grammar. These three *carnicerías* were not included as part of the intervention/training treatment, although they received minimal compensation for their respective times. Instead, these sessions allowed the instructor to practice the presentations in front of an audience and to gain verbal feedback on the delivery and use of the materials, as well as test the reliability of the evaluation instruments. The number of participants in this phase of the project was smaller than typically seen in a pilot test (2).

For the intervention/training aspects of the research, a pre-test, consisting of five food safety knowledge questions, five behavioral questions, five attitude questions, and performance of a skill (handwashing), was administered to employees from 20 stores. This approach was designed to determine the employees’ baseline food safety knowledge and skill. The pre-test data were analyzed to ensure that treatment groups were being treated equally. The ANOVA results indicate the pre-test scores were not significantly different between the two treatment groups. There was at least a two-week delay period between the pre-test and the intervention/training. After the intervention/training, minimal compensation was given.

The two training lessons were administered to the treatment group only (10 stores; 16 employees), the control group (10 stores; 13 employees) did not receive any treatment. The two lessons provided the treatment group with the necessary materials to take action(s) that ensure proper food safety practices. After the lessons were provided, approximately two weeks passed before the post-test was administered to both groups. This approach was performed to prevent memorization and to assess knowledge retention. After the post-test, minimal compensation was given.

Approximately three weeks after the post-test, a delayed post-test was administered to both groups. Both the post-test and the delayed post-test were identical to the pre-test. Each test was given orally to the individuals. Also, at the final visit, employees felt comfortable enough with the researchers to answer the questions on the demographic questionnaire.

Finally, the researchers returned to the experimental control groups to obtain consent and offered the food-safety intervention/training program. All participants were debriefed on the study blinding of treatment groups and received a certificate of completion, along with minimal compensation.

Six-month follow-up (second round of observations)

To ascertain the long-term effects of the training program, a second research group consisting of two additional, but different, individuals (one of them Hispanic) conducted concealed-direct observations six months after the completion of the intervention as described previously.

TABLE 1. Demographic characteristics of employees at carnicerías in Reading, PA

| Control Demographic characteristics | Treatment (n = 13) | Total (n = 16) | Total (n = 29) |
|--|-------------------------------|---------------------------|---------------------------------|
| Gender | | | |
| Male | 37.9%(11) | 41.4%(12) | 79.3%(23) |
| Female | 6.9% (2) | 13.8%(4) | 20.7%(6) |
| | 44.8%(13) | 55.2%(16) | 100.0%(29) |
| Country of origin | | | |
| Dominican | 34.5%(10) | 37.9%(11) | 72.4%(21) |
| Mexican | 3.5%(1) | 17.2%(5) | 20.7%(6) |
| Puerto Rico | 6.9%(2) | 0.0%(0) | 6.9%(2) |
| | 44.8%(13) | 55.2%(16) | 100.0%(29) |
| Years of school completed | | | |
| 8th grade or less | 17.2%(5) | 6.9%(2) | 24.1%(7) |
| Some high school | 20.7%(6) | 13.8%(4) | 34.5%(10) |
| High school | 3.5%(1) | 24.1%(7) | 27.6%(8) |
| Some college | 3.5%(1) | 10.3%(3) | 13.8%(4) |
| Bachelor's degree | 0.0%(0) | 0.0%(0) | 0.0%(0) |
| | 44.8%(13) | 55.2%(16) | 100.0%(29) |
| Age in years | | | |
| 18–25 | 6.9%(2) | 10.3%(3) | 17.2%(5) |
| 26–35 | 6.9%(2) | 13.8%(4) | 20.7%(6) |
| 36–45 | 20.7%(6) | 17.2%(5) | 37.9%(11) |
| 46–55 | 6.9%(2) | 6.9%(2) | 13.8%(4) |
| 56–65 | 3.5%(1) | 6.9%(2) | 10.4%(3) |
| 65 and over | 0.0%(0) | 0.0%(0) | 0.0%(0) |
| | 44.8%(13) | 55.2%(16) | 100.0%(29) |
| Years worked with food in a retail setting | | | |
| 0–1 | 3.5%(1) | 20.7%(6) | 24.1%(7) |
| 2–5 | 6.9%(2) | 20.7%(6) | 27.6%(8) |
| 6–10 | 10.3%(3) | 3.5%(1) | 13.8%(4) |
| 11–19 | 6.9%(2) | 6.9%(2) | 13.8%(4) |
| 20+ | 17.2%(5) | 3.5%(1) | 20.7%(6) |
| | 44.8%(13) | 55.2%(16) | 100.0%(29) |
| Years owning this store | | | |
| 0–1 | 0.0%(0) | 20.7%(6) | 20.7%(6) |
| 2–5 | 20.7%(6) | 3.5%(1) | 24.1%(7) |
| 6–10 | 0.0% | 0.0%(0) | 0.0%(0) |
| 11–19 | 0.0% | 3.5%(1) | 3.5%(1) |
| 20+ | 3.5%(1) | 0.0%(0) | 3.5%(1) |
| | 24.1%(7) | 27.6%(8) | 51.7%(15)- Not owner |
| Number of employees at this store; part-time or full-time | | | |
| 0–1 | 3.5%(1) | 0.0%(0) | 3.5%(1) |
| 2–5 | 24.1%(7) | 44.8%(13) | 69.0%(20) |
| 6–10 | 17.2%(5) | 3.5%(1) | 20.7%(6) |
| 11–19 | 0.0%(0) | 6.9%(2) | 6.9%(2) |
| 20+ | 0%(0) | 0.0%(0) | 0.0%(0) |
| | 44.8%(13) | 55.2%(16) | 100.0%(29) |
| Number of different customers per week | | | |
| 0–25 | 0.0%(0) | 0.0%(0) | 0.0%(0) |
| 26–50 | 0.0%(0) | 0.0%(0) | 0.0%(0) |
| 51–75 | 0.0%(0) | 0.0%(0) | 0.0%(0) |
| 76–100 | 0.0%(0) | 0.0%(0) | 0.0%(0) |
| 101+ | 44.8%(13) | 55.2%(16) | 100.0%(29) |
| | 44.8%(13) | 55.2%(16) | 100.0%(29) |

Statistical analysis

Descriptive statistics were used on the concealed-direct observations data and demographics. For knowledge and skill aspects of the training, data were entered into the Statistical Package for Social Sciences (SPSS V.18) for statistical analysis (SPSS Inc 2001, Chicago, IL) and an Analysis of Covariance (ANCOVA) test was run. Reliability was determined using the split-half method (knowledge and skill) and Cronbach's alpha (behavior and attitude). Results were considered to be significant at 0.05 or less ($P \leq 0.05$).

ANCOVA was used to determine if a difference existed between the delayed post-test scores, as well as post-test scores between treatment groups when controlling for the pre-test scores for knowledge and skill tests. ANCOVA was also completed on the control group to determine if a significant testing bias was observed when controlling for the pre-test. The statistical assumptions of normality and homogeneity (equal variance) were assessed with skewness/kurtosis values and Levene's test, respectively.

RESULTS

The demographic data were divided according to group assignment: experimental control and treatment group. The age of participants, number of years in the food industry, number of years as owner of the *carnicería*, number of people working in the *carnicería*, and number of customers were measured in categories and therefore represent ordinal categories. The following categories/questions used were as follows. The age variable was divided into the following age categories: 18–25, 26–35, 35–44, 45–55, 56–65 and 66 years and older. The results for the question, “How many people shop at your *carnicería* in one week?” were divided into the following categories: 0–25 people, 26–50 people, 51–75 people, 76–100 people, and 101 or more people. The question, “How long have you worked with deli foods?” was asked and results divided into the following categories:

0–1 year, 2–5 years, 6–10 years, 11–19 years, or 20 or more years. The question, “How long have you owned the *carnicería*?” was asked and the answers divided into the following categories: 0–1 year, 2–5 years, 6–10 years, 11–19 years, 20 or more years, or NA–Not Applicable. The results to the question, “How many people work at this *carnicería*?” were divided into the following categories: 1 person, 2–5 people, 6–10 people, 11–19 people, or 20 or more people. The question, “Years of school completed,” was divided into the categories 8th grade or less, some high school, completed high school, and some college/trade school. Nationality (Country of Origin) was asked and the results divided into the following categories: Mexican, Dominican Republic, Puerto Rican, or other. Gender was asked as part of the survey and was measured nominally. The summary of these data can be found in Table 1 and in a thesis (21).

Reliability analysis was conducted on the pre-test, using the split-half method. Descriptive statistics were calculated for the control group and the treatment group. The knowledge and skill scores for employees were averaged within a given store so there are a total of ten knowledge and ten skill scores (one for each store). The researchers collected the skill data by observing employees washing their hands after being asked to do so. The skill test had a total of five possible points. This approach was used so each step completed in the correct order was assigned one point. Proper steps were listed as follows: (1) rinsing hands; (2) applying soap on wet hands; (3) vigorously applying friction to the palms of hands, fingers and top of hands for ten to fifteen seconds; (4) rinsing hands; (5) drying hands with paper towel or clean hand cloth. If any steps were not completed, or completed incorrectly or in the wrong order, the employee was given zero points for that part of the skill.

Table 2 demonstrates retention of knowledge and skills based on significantly different ANCOVA results from pre- to post- to delayed-post testing. Behavior and attitude analyses were found to be reliable but not significantly different from the control. Table 3 summarizes the practices observed during the concealed-direct observations

TABLE 2. ANCOVA results for food safety knowledge and skill from *carnicería* employees

| | | N | Control SD | Adjusted Mean | N | FTF-trained SD | Adjusted | F value ^a |
|-----------|-------------------|----|---------------|------------------|----|-------------------|----------|----------------------|
| Knowledge | Pre-test | 10 | 0.5 | - | 10 | 0.4 | - | - |
| | Post-test | 10 | 0.7 | 0.6 | 10 | 0.8 | 4.3 | 121.6* |
| | Delayed Post-test | 10 | 0.5 | 2.5 | 10 | 0.8 | 5.0 | 54.9* |
| Skill | Pre-test | 10 | 1.3 | - | 10 | 0.5 | - | - |
| | Post-test | 10 | 1.0 | 3.1 | 10 | 0.0 | 5.0 | 38.9* |
| | Delayed Post-test | 10 | 1.3 | 2.4 | 10 | 0.0 | 5.0 | 54.8* |

*Significant at 0.05 level

Key: N: Number of Participants SD: Standard Deviation

^aF Value from ANCOVA of post-test or delayed post-test by group assignment with pre-test as the covariant

collected before the training. Table 4 summarizes the practices observed during the concealed-direct observations collected 6 months after the training. It should be noted that participants in the study who received compensation told the researchers they used the gift cards to purchase cleaning supplies such as bleach, sponges, and rubber gloves.

At the 6-month concealed-direct assessments, all intervention participants demonstrated improvement in the behaviors listed in Table 3, except handwashing before waiting on the customer. At the time of the assessment, it was observed that 50% of the *carnicerías* that participated in the training intervention were pre-slicing all of their products in the morning to prevent cross-contamination during busy hours of the day. Therefore, the product was already bagged and employees did not have to handle the product, thereby explaining the lack of handwashing before waiting on the customer. The observers witnessed efforts being made to follow appropriate food safety training procedures, including proper glove use and use of sanitizers. Some of the stores no longer sold raw meat; this observation was most likely to reduce the risk involved with handling this product. Observers asked employees in some stores with pre-sliced meat to slice them fresh ham and the employees responded, "...that the

slicer needed to be cleaned and sanitized and they should come back later, since it was a busy time of day." At one store, the manager asked one of his employees to handle the RTE meat since he was "really busy." The employee disputed, "But I don't have gloves on and I am handling cash!" From these observations, it is clear that the training intervention had an impact on the participants. While food safety improvements are still needed with this audience, these observations indicate that the training was a promising start.

Thirty-one participants took the pre-test in its entirety. There was good retention in this small sample; only two individuals dropped out of the study, and this was only because the employees were no longer working at the *carnicerías* at the time of the post-test. These scores were removed from the results to be consistent throughout the analyses. Therefore, twenty-nine individuals completed the study, originating from twenty different *carnicerías* (ten in each treatment group).

Statistical analysis demonstrated that there was a significant gain in food safety knowledge by the FTF-trained group and a significant improvement in ability to perform a food safety-related skill (handwashing) correctly. The control group used in the study did not receive any training, thereby allowing the researchers to attribute all improvement in scores, from all assessments, to the FTF-trained method. The knowledge gained for the FTF-trained group for the post-test was 3.70 ± 0.78 points (five possible points). For the

TABLE 3. Results of the concealed-direct observations used to determine the training needs of workers in *carnicerías*

| Parameter | Personal Hygiene | Sanitation/ Cross-contamination | Handwashing |
|--------------------|--|--|---|
| Percent compliance | 27% Employees wearing hairnets or hats | 10% Employees using gloves properly | 3% Employees washing hands before waiting on customers |
| | 77% Employees not wearing jewelry | 13% Employees working with clean slicers | 23% Stores with operational handwashing stations |
| | 83% Employees not eating or chewing gum | 10% Employees working with clean display cases* | 37% Stores with handwashing stations and paper towels |
| | | | 40% Stores with handwashing stations and soap |

N = 30

*Cases were evaluated on organization, storage of product (trays or no trays), presence or absence of spoiled product, and general grease or level of cleanliness in the display case.

TABLE 4. Results of the second round of concealed-direct observations used to determine post-intervention behaviors

| Parameter | Personal Hygiene | Sanitation/ Cross-contamination | Handwashing |
|--------------------|---|---|---|
| | 50% Employees wearing hairnets or hats | 38% Employees using gloves properly | 0% Employees washing hands before waiting on customers |
| Percent compliance | 88% Employees not wearing jewelry | 88% Employees working with clean slicers | 63% Stores with operational handwashing stations |
| | 100% Employees not eating or chewing gum | 100% Employees with clean display cases* | 64% Stores with handwashing stations and paper towels |
| | | | 75% Stores with handwashing stations and soap |

N=24

*Cases were evaluated on organization, storage of product (trays or no trays), presence or absence of spoiled product, and general fat or level of cleanliness in the display case.

delayed post-test, scores were 3.85 ± 0.76 , which were greater than the pre-test scores. The control group did not show any improvement in knowledge post-test or delayed post-test when compared to the pre-test. The knowledge part of the assessments was determined to be reliable, with an internal reliability coefficient greater than 0.70. The skill improvement scores are statistically significant at the 0.05 level. The FTF-trained group demonstrated an improvement of 2.15 ± 0.00 for the post-test and 2.15 ± 0.00 delayed post-test, as compared to the pre-test. The control scores did vary, but ultimately did not improve with regard to performing a skill, compared to the pre-test. The skill part of the assessments was determined to be reliable, having an internal reliability coefficient greater than 0.70.

DISCUSSION

To ascertain the food safety needs of the population, concealed-direct observation was utilized to complete a needs assessment for the target audience. To our knowledge, this approach has not been used with this target audience. A training intervention was then developed for employees of Hispanic meat delicatessens (also known

as *carnicerías*). The training intervention was designed to teach four basic tenets of food safety to a Spanish speaking audience. The intervention was accomplished using a “table-top/counter-top training” that reinforced concepts by use of photographs and oral instruction.

The findings indicate that knowledge retention is difficult to associate with improved attitude and altered behavior. A model developed by Allport (1) linked the learning of information with attitudes and behaviors. This model stated that people first acquire information about a behavior, which leads to development of an attitude, which then leads to a behavior that is in agreement with the attitude. A high correlation for testing any of the points of the model (information versus attitude or attitude versus behavior) would indicate support for the model. Rennie (19) reports that little success has been gained from this type of model, especially where the knowledge base of the target group is low. The study used the TM partly because motivation and personal change are linked, and therefore the willingness to change must be internal, which could result in a greater possibility for that change to occur (12).

To reduce the likelihood of a threat of a ceiling effect (a ceiling effect is a threat to the research when the individuals participating have previous knowledge about the subject matter and can score high on a pre-test) from pre-test to post-test to delayed post-test, the difficulty of the questions/material could be increased throughout the testing. It would be ideal to complete the pilot test on a larger sample size (~20 employees) to ensure that questions are well worded and that the training pertains to the work/concerns of employees working at the *carnicerías*. It would be best if employees would complete all evaluation tools. The scores on the tools could be used to better calculate the reliability of the test items and determine which items, if any, need to be eliminated or modified.

Additionally, a larger sample size for the training intervention would be ideal. The current study was limited in this regard because of geography and a specifically targeted audience. Participation could be improved by working with local health inspectors who are willing to adopt food safety training to the local stores under his/her supervision. This approach would help with buy-in within the community and prevent issues with turnover or mortality throughout the intervention. Another option is to increase sample size by using an incentive at the beginning of the study, thereby enticing more individuals to participate during recruitment. Additionally, photographs could be taken at actual *carnicerías* so that they do not appear to be staged.

A limitation of the experiment was that literacy, while not formally measured, affected the entire design of the intervention. Most individuals could not read their own language. To address this issue, a picture-based, table-top/counter-top training guide, with oral teaching support, was designed and delivered. Although behavior or attitude results revealed no significant change, the intervention had several promising aspects. While many participants appeared to be illiterate and spoke only Spanish, the training program did increase knowledge and teach proper food safety skills, indicating that an intervention can be created for nearly any audience.

Psychologists have distinguished two types of learning: declarative knowledge (the knowledge of “what is,” such as knowing that cleaning and sanitizing must occur every four hours) and procedural knowledge (the knowledge of “how to do things,” such as washing one’s hands; (29). The increased knowledge and improved food safety skill should benefit directly the citizens who use the *carnicerías* on a daily basis, in part because of the decreased risk of foodborne illness that results from the increased knowledge (declarative knowledge; there was no significant change in procedural knowledge), and more importantly, following proper procedures within the meat delicatessen environment. As mentioned previously (5, 11, 28), when proper food safety behavior is either unknown or ignored by food handlers, it can lead to increased incidence of foodborne illness, and possibly death.

The results of this study also demonstrate several additional findings. Concealed-direct observations are an acceptable means of observing true food safety behaviors. As indicated earlier, this approach has promise as a way to conduct a needs assessment for an uninformed target audience. Imparting knowledge that a subject wants to know can lead to greater retention of the lesson, for

some period of time. An effective training intervention can occur for nearly any audience, provided that proper understanding of how that audience wants to learn is reinforced through teaching. At the time of this project, there was no mandated food safety training in Reading, PA. However, the current intervention could provide a foundation for conducting effective future food safety efforts.

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REFERENCES

1. Allport, G. 1935. Attitudes. A handbook of social psychology. MA: Clark University Press. 798–844.
2. Babbie, E. 2005. The basics of social research, 3rd ed. Belmont, CA: Thomson Wadsworth.
3. Centers for Disease Control and Prevention (CDC). 2010. CDC reports 1 in 6 get sick from foodborne illnesses each year. Available at <http://www.cdc.gov/mediapressrel/2010/r101215.html>. Accessed: 16 December 2010.
4. Godwin, S. L., and E. Chambers IV. 2009. Observational research: A tool for collecting behavioral data and validating surveys. Presented at the 2009 Summer Program in Sensory Evaluation Symposium. Available at: http://www4.hcmut.edu.vn/~dzung/spise2009/fullpapers/ObservationalResearch_Godwin.pdf. Accessed: January 2, 2011.
5. Green, L. S., C. Radke, V. Mack, D. W. Reimann, T. Stigger, M. Motsinger, and L. Bushnell. 2006. Food worker hand washing practices: an observational study. *J. Food Prot.* 10(24):17.
6. Gupta, K. 1999. A practical guide to needs assessment. San Francisco: Jossey-Bass.
7. Hazelwood, D., and A. D. Maclean. 1993. Curso de higiene para manipuladores de alimentos. Zaragoza, Spain: Acribia.
8. Kirby, M. P., and K. Gardiner. 1997. The effectiveness of hygiene training for food handlers. *Int. J. Hyg. Environ. Health* 7:251.
9. Kristal, A.R., K. Glanz, S. J. Curry, and R. E. Patterson. 1999. How can stages of change be best used in dietary interventions? *J. Am. Dietetic Assoc.* 99:679–684.
10. Lubran, M. B., R. Pouillot, S. Bohm, E. M. Calvey, J. Meng, and S. Dennis. 2010. Observational study of food safety practices in retail deli departments. *J. Food Prot.* 73:1849–1857.
11. McCabe-Sellers, B., and S. E. Beattie. 2004. Food safety: Emerging trends in foodborne illness surveillance and prevention. *J. Am. Dietetic Assoc.* 104:1708–1717.
12. Miller, W. R. 1999. Enhancing motivation for change in substance abuse: Treatment improvement protocol series #35. U.S. Department of Health and Human Services. Washington, D.C.
13. Nieto-Montenegro, S., J. L. Brown, and L. F. Laborde. 2004. Evaluating food safety needs in the food industry using a “worker-experience” protocol. *Food Prot Trends* 24:676–681.
14. Nieto-Montenegro, S., J. L. Brown, and L. F. Laborde. 2006. Using the health action model to plan food safety educational materials for Hispanic workers in the mushroom industry. *Food Control* 7:757–767.
15. Nieto-Montenegro, S., J. L. Brown, and L. F. Laborde. 2008. Development and assessment of pilot food safety educational materials and training strategies for Hispanic workers in the mushroom industry using the health action model. *Food Control* 19:616–633.
16. Norris, P. 2004. Reasons why mystery shopping is a useful and justifiable research method. *Pharm. J.* 272:746–747.
17. Patton, S.Q. 2002. Qualitative research and evaluation methods. CA: Sage Publications. 3rd Edition.
18. Prochaska, J.O., C. DiClemente, S. K. Fairhurst, M. M. Valasquez, W. F. Velicer, and J. S. Rossi. 1991. The process of smoking cessation: An analysis of precontemplation, contemplation, and preparation stages of change. *J. Consult. Clin. Psych.* 59:295–394.
19. Rennie, D. M. 1995. Health education models and hygiene education. *J. Royal Soc. Prom. Health.* 115:75–79.
20. Rheinlander, T., M. Olsen, J. A. Bakang, H. Takyi, F. Konradsen, and H. Samuelson. 2008. Keeping up appearances: perceptions of food safety in urban Kumasi, Ghana. *J. Urban Health* 85:952–964.
21. Richard, A., Development and implementation of a “counter-top” training program to increase retention of food safety knowledge, alter behavior, improve attitude, and increase skills of Spanish-speaking retail employees. Thesis. Penn State University. Available at: <https://etda.libraries.psu.edu/paper/11648/>. Accessed: August 8, 2012.
22. Rimmer, B., and K. Glanz. 2005. Theory at a glance – A guide for health promotion practice. Second Edition. Bethesda, MD: U.S. Department of Health and Human Services.
23. Takeuchi, M. T., M. Edlefsen, S. M. McCurdy, and V. N. Hillers. 2005. Educational intervention enhances consumers’ readiness to adopt food thermometer use when cooking small cuts of meat: An application of the transtheoretical model. *J. Food Prot.* 68:1874–1883.
24. Troxell, T., and R. Buckner. 2000. Food safety in the new millennium: the past is the prologue. *Cer. Foods World* 45:169–172.
25. US Census Bureau. 2009. State & county quickfacts: Reading, PA. Available at <http://quickfacts.census.gov/qfd/states/42/4263624.html>. Accessed: November 27, 2009.
26. Wilson, A. 2001. Mystery shopping: Using deception to measure service performance. *Psych. Mark.* 18:721–734.
27. World Health Organization. 2000. Foodborne disease: A focus for health education. Geneva: World Health Organization.
28. Worsfold, D., and C. J. Griffith. 1997. Assessment of the standard of consumer food safety behavior. *J. Food Prot.* 60:399–406.
29. Worsley, A. 2002. Nutrition knowledge and food consumption: can nutrition knowledge change food behaviour? *Asia Pacific J. Clin. Nutr.* 11:S579–S585.